DOCUMENT RESUME

ED 479 447 IR 022 124

AUTHOR	Cristea, Alexandra; Okamoto, Toshio; Kayama, Mizue
TITLE	Considerations for Building a Common Platform for Cooperative and Collaborative Authoring Environments.
PUB DATE	2002-10-00
NOTE	9p.; In: E-Learn 2002 World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education. Proceedings (7th, Montreal, Quebec, Canada, October 15-19, 2002); see IR 022 093.
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS
DESCRIPTORS	Authoring Aids (Programming); Computer Interfaces; *Computer Software Development; *Computer System Design; *Cooperative Programs; Educational Technology; Instructional Materials; Material Development; Programmed Instructional Materials; *Programming; *Standards
IDENTIFIERS	Collaborative Research

ABSTRACT

This paper reports on considerations about the common basic functions and components for building a collaborative authoring environment. The paper aims to specify and systematize the technological issues towards the future standardization of such environments, based on the authors' previous research experiences. Standardization includes many difficult aspects, however, it will extend and widen the field of applications possible within the collaborative and cooperative authoring paradigm, and will enable the usage of the fruits of years of research and individual implementations of the concept of collaborative, but mostly, cooperative authoring. This paper tries to set a systematic basis for a common collaborative authoring platform. (Contains 18 references.) (Author)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 479 447

Considerations for Building a Common Platform for Cooperative and Collaborative Authoring Environments

Alexandra Cristea[1], Toshio Okamoto[2] and Mizue Kayama[3]

[1]Faculty of Mathematics and CS, Technical University Eindhoven, The Netherlands
a.i.cristea@tue.nl

[2]Graduate School of IS, University of Electro-Communications, Japan
okamoto@ai.is.uec.ac.jp

[3]Senshu University, School of Network and Information, Kanagawa, Japan
kayama@isc.senshu-u.ac.jp

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

G.H. Marks

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Abstract: This paper reports on considerations about the common basic functions and components for building a collaborative authoring environment. We aim to specify and systematize the technological issues towards the future standardization of such environments, based on our previous research experiences. Standardization includes many difficult aspects, however it will extend and widen the field of applications possible within the collaborative and cooperative authoring paradigm, and will enable the usage of the fruits of years of research and individual implementations of the concept of collaborative, but mostly, cooperative authoring. In this paper, we try to set a systematic basis for a common collaborative authoring platform.

Introduction

Cooperative and collaborative authoring (C^2A) are fundamental authoring forms that become more important with the paradigm shift towards re-usage and cooperation in the current authoring technology. The objects of C^2A are the *collaborative mutual interdependence* relations and the *group-implying activities* (Okamoto et al 2000; 2001).

Simply put, in pure *collaborative authoring*, each author takes over (an) authoring sub-task(s). When each author accomplishes the sub-task(s), the group goal is reached and collaborative mutual interdependent authoring is achieved.

In the wider spread *cooperative authoring*, authors just re-use each other's materials, (teaching) style, learning goal settings, dictionaries, linking and sequencing, etc.

Distributed C^2A is a type of collaborative authoring that can take place in the network environment, etc., with multiple authors virtually far from one another (comparable to the situation in O'Malley 1994). A virtually distanced setting can mean remote physically (geographically), but also covers cases where direct interaction and dialogue among participants is not possible due to other reasons. Distributed C^2A support is a pioneering research domain that tries to find out ways to support the cooperation and collaboration (C^2) of multiple authors on the network.

Computer Supported C^2A (CSC^2A) is directly connected to distributed collaborative learning (CSCL - Computer Supported Collaborative Learning) (ISO/IEC), in cooperative curriculum-related activities, according to the used Learning Technology (IEEE LTTF), on one hand, and to CSCW (Computer Supported Cooperative Work) (Conklin & Begeman 1988; Malcolm & Crowe 1994; Winograd & Flores 1986) on the other. Compared to CSCW, CSC^2A has the same direct goal, i.e., *working efficiency*, in the sense of authoring achievement efficiency combined with the recognition or meta-recognition of the subject field. At the same time, CSC^2A has as a final goal *the student learning*

IR022124

BEST COPY AVAILABLE

achievement efficiency, borrowed from CSCL (Dillenbourg 1999; Okamoto et al 2001).

The regular CSC²A-management software implementation should provide therefore two types of activity space: a *private working space* and a *collaborative working space*. The first is, unlike in collaborative learning (Okamoto et al. 2001), just a space for processing the material into a final form, to be copied into the collaborative space. In pure collaboration this private space practically disappears, as authoring becomes an iterative, peer-feedback dependent process. Here, authors can exchange information in a synchronous, but mostly, asynchronous manner. Many researches are studying these two types of activity spaces for learning environments (Okamoto 2000; Okamoto et al. 2001;Synnes et al. 1999), but not enough studies focus on authoring purposes. We now propose to analyse the case of the C²A Environment (C²AE) (Cristea et al. 2001), by mapping it over the previously proposed collaborative learning environment case (Okamoto et al. 2000) and extracting analogies.

CSC²A can be organized at many levels, starting with the selection of the appropriate knowledge representation and inference mechanism (Dicheva et al. 2002). Our current paper goes one step further and focuses on the interaction activities, the structural model they imply and the interfacing of these structural component objects. As this framework is aimed at covering the need of coordination and facilitation of authors working together towards one/more common/disjunctive authoring goal(s), we use the adjective 'collaborative' for describing both objects and activities, as being more powerful and restrictive than its counterpart, 'cooperative'. Mainly, if collaboration is possible, cooperation results implicitly. Moreover, by removing some of the features and restrictions, the collaborative environment can become a cooperative one.

Primitive Activities and Required Resources in C²A

In this section, we describe the primitive interaction activities among participants in C²A, from a macro-granulation perspective. From a technological viewpoint, every CSC²A should provide appropriate tools ensuring a flexible, viable selection of these activities. Here we list them in their order of priorities: *Planning/ Execution/ Creation; Coordination / Control; Initiative/ Supervision; Observation / Suggestion; Data / Idea sharing; Dialogue (with Interaction)*.

Surprisingly, compared to collaborative learning (Okamoto et al. 2000) only *Turn Taking* doesn't appear as a primitive activity, and supplementary to pure Execution, *Creation*, as a higher level execution form - implying new knowledge addition - appears. To perform these activities, the following resources are required in C²A environments: *Personal Workplace; Shared Workplace (shared object space); Dialogue Channel (implicit or explicit); Technologically mediated remote communication (audio, visual)* – latter optional for cooperative environment. Furthermore, more refined cognitive tools are desirable for facilitating group collaborative authoring, such as, e.g., concept mapping tools (Cristea et al. 2001), etc. Therefore, we consider that an essential condition for CSC²A systems is that the common platform/ infrastructure should have at least the above-mentioned resources built-in.

C²AE Structural Model

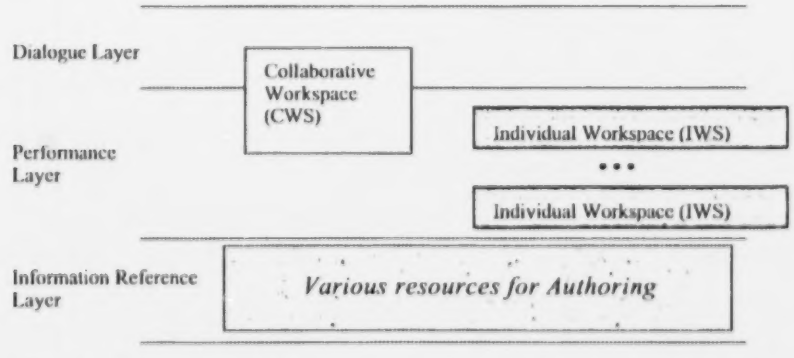


Figure 1: The Global Structural Model of the Cooperative and Collaborative Authoring Environment

BEST COPY AVAILABLE

Figure 1 displays the C^2A concept from the point of view of the author behavior and the resource usage. We can differentiate between *author-to-author dialogue* (communication) and *other activities* (curriculum creation, etc.).

Note that we include the coordination activities in the latter category. The figure shows the layers for the C^2A goal and C^2 work, as well as the layer containing the various authoring resources to consult during C^2A. These include all possible resources to which the author has access during authoring in an Internet environment (e.g., authoring materials, all-purpose tools, specialized tools, authoring applications, various authoring data, etc.).

In C^2A an author can face an authoring task that s/he doesn't have either time or personal resources to fulfill and, by interactions with other authoring companion(s), or by consulting other materials, can exchange meaningful information and notice other ways of perception and teaching. As authoring efficiency has been shown to increase in C^2A situations (Dicheva et al. 2002), some systems try to encourage collaboration and especially re-usage with the help of computer implementations.

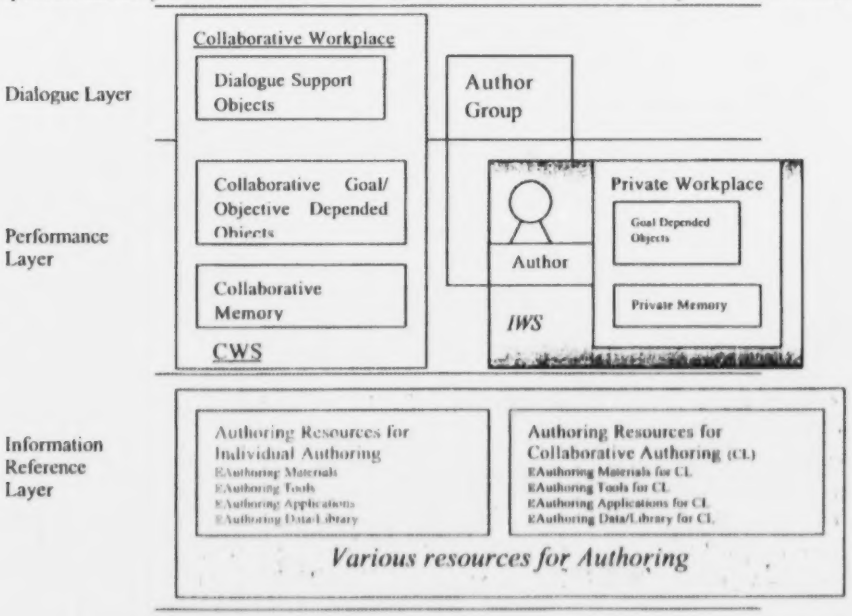
C^2AE Structural Components

Collaborative Authoring Model Elements

Figure 2 shows more details and various essential elements of the conceptual image of the C^2A model, where workplace and working subjects are brought together. Authors can belong to one or more groups, or none at all (pure re-usage, i.e., cooperation) and can be involved in curriculum creation projects or parts of projects together, therefore sharing that particular space (pure or partial collaboration) and work privately for the rest.

The C^2A shared (collaborative) workplace contains *dialogue support objects* for information exchange support, *collaborative work & goal objects* for authoring related support and the *collaborative memory*, for reference and information and end-product (course, etc.) accumulation (Fig. 2).

The private workplace contains the *work & goal repository* of the private working objects and the *private memory* for consultation and accumulation of information on private activities, notes, etc.



BEST COPY AVAILABLE

Moreover, the figure also details the information referencing layer that is shown to contain information oriented towards individual and collaborative authoring goals, authoring materials, various educational data, libraries, educational applications, all-purpose tools, market applications, etc.

Please note that both workplaces (private and C^2) are part of the respective workspace. In an analogy with the traditional classroom, we could say that, for a learning environment, the classroom itself is (part of) the collaborative workspace, while the collaborative workplace contains the blackboard, which is accessible and visible to everyone (and has a certain access policy, determined by the teacher agent).

C^2AE Structural Elements

There are six essential basic structural elements (objects) for building the C^2A environment. Due to lack of space, only the first hierarchical layer of definitions will be presented in this article.

1. C^2AE Representation: Many systems have already used the collaborative learning paradigm (Okamoto et al. 2000) and helped towards extrapolating the important structural points of a C^2AE (Fig. 1,2). To define the C^2AE, we need to define the following six concepts: *General structural model of the C^2AE; Essential structural elements of the C^2AE* and their *Attribute(s)* and *Relation(s); Dynamical model of the C^2AE (data transmission model); Dynamical mechanism of the C^2AE (data exchange mechanism)*. These are shortly described in this paper.

2. Collaborative Workspace Representation: The collaborative workspace is an essential structural element of the collaborative part of the C^2AE that establishes a virtual space for collaborative activities for authoring groups and collaborating individuals, and ensures the continuity of these collaborative activities within that space (by activity related information recording, etc.). Moreover, this space also provides functionalities for the cooperative activities. The workspace definition requires the definition of the following terms below: *Structure of C^2A workspace*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*.

3.Authoring Resource(s) Representation: C^2A resource(s) have to be guaranteed for private activities, collaboration (screen sharing, operation sharing) and cooperation (repository sharing). Here we need to define: *Essential structural elements of the C^2A resource(s); Fundamental referencing model of resources* (e.g., Dicheva et al. 2002).

4. Collaborative Workplace Representation: The collaborative workplace belongs to the *collaborative workspace*, and is an essential component of the C^2 working environment, used in groups for collaboration, or, with respect to the outer world, in cooperation. Namely, the collaborative workplace is in a "use_of" relation with the group and the private author. This workplace is determined, as already mentioned in the previous sub-section, by the *collaborative communication (dialogue) support objects* for distant group members, by *C^2 work & goal objects* and by the *collaborative memory* that uses both previous object types for storage and retrieval. The defining of the collaborative workplace requires the definition of the terms below: *Collaborative workplace structure*, its *Essential elements* and their *Attributes* and *Relation(s)*.

5. Collaborative Author Group Model

The group is defined within the collaborative workspace of the collaborative authoring environment. The group uses the collaborative workplace and pursues the collaborative authoring goal. This goal is defined as a set of individual achievements expected from the multiple members of the group. To define the author group model, the following elements and terms must be defined: *Group model structure*, its *Essential elements* and their *Attribute(s)*.

6. Collaborative Memory Structure Representation

The collaborative memory (CM) is included in the collaborative workplace of the collaborative workspace. It serves to store the objects used for dialogue support and objects used and developed in C^2A. Moreover, it has the role to retrieve these objects and stored information at request (later on, the CM or a copy of it will have to respond to requests in relation with learning). To define the collaborative memory structure, the definition of the following terms is necessary: *Collaborative memory structure*, its *Essential elements* and their *Attribute(s)* and

Relation(s).

C^2AE Data Transmission Model and Interface Objects

Data Transmission Model in the C^2AE

Figure 3 shows the data transmission model in a C^2AE populated with authors and author group(s). The C^2A support system has to be able to send and receive, at the author's request, essential information regarding the C^2 and private workspace elements. Figure 3 illustrates our hypotheses by displaying a minimum of required relations. For example, a function has to be built that is able to fetch C^2 or private work objects requested by the group or privately from various resource(s), here represented by the *load_into* relation.

Interfaces

Five interfaces for the common objects can be defined, as briefly described below.

1. Interface between Authoring Resource(s) and C^2 Work Object(s)

The group performs collaborative activities by loading the C^2 work object(s) of the collaborative workplace from the authoring resources, for group and personal use. Authoring resource(s) are used by multiple groups or individuals. By activating a group request, a memory image of the requested authoring resource(s) is produced, and therefore the collaborative work object(s) of the group collaborative workplace come into being. For defining this interface and its regulations, the following must be defined: *Authoring resource(s) reference structure,* its *Essential elements* and their *Attribute(s)* and *Relation(s); Protocol between the authoring resource(s) agent and the collaborative work object agent.*

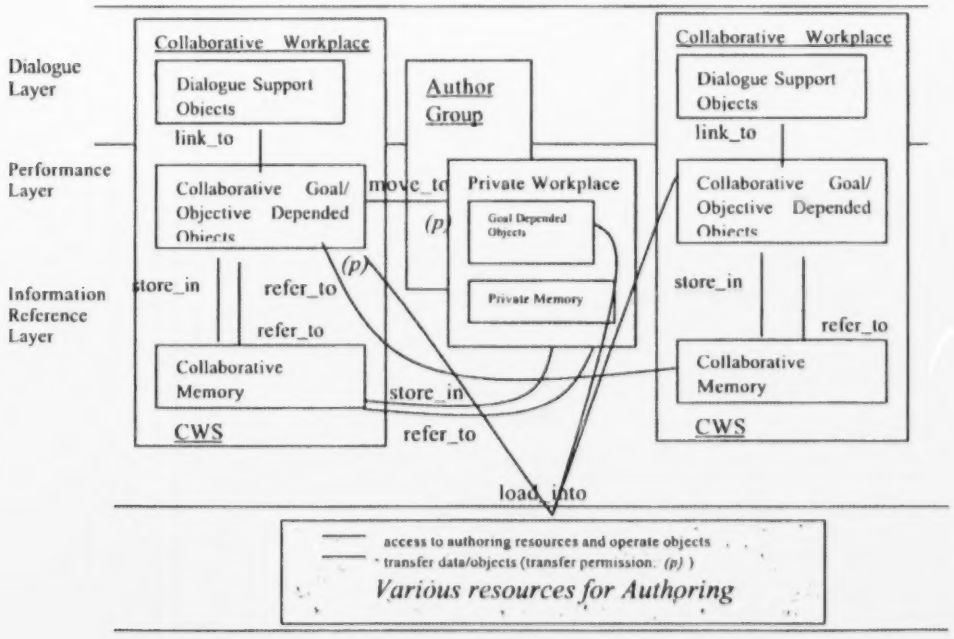


Figure 3: Data transmission model of the Cooperative and Collaborative Authoring Environment

BEST COPY AVAILABLE

2. Interface between Dialogue Support Object(s) and Collaborative Work Object(s)

The dialogue support objects enhance the information exchange between authors and manage the communication activity history. The role of the communication among authors is to support and smoothen the various authoring activities managed by collaborative work object(s). Namely, the communication that takes place in order to achieve the group-authoring goal is closely related to communication in collaborative work for problem solving. For the computer to understand the meaning of the communication, it is necessary to link the output of the dialogue support object and the collaborative working object (proper ontological representation). For this purpose, the items below need to be defined: *Dialogue support object and collaborative work object output data structures*, their *Essential elements* and *Attribute(s)*.

3. Interface between the Private Workspace and C^2 Work Object(s) of the Collaborative Workplace

C^2A does not always take place in the collaborative workspace. A group member or an independent author can bring in work results from the author's private workplace to the collaborative workplace, or the work result from the collaborative workplace can be copied to the private workplace. Therefore, next to the definition of the C^2 work object input data, the definition of the output data of the private workplace is also necessary, as follows: *Private workplace output data structure*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*; *Protocol between the private workplace agent and the collaborative workplace agent*; *Protocol between the collaborative workplace agent and the collaborative work object agent*.

4. Interface between C^2 Work Object(s) of the Collaborative Workplace and the Collaborative Memory

The C^2 work object output data is the authoring log data. The interface uniformity between the C^2 work object(s) and the collaborative memory within the collaborative workplace is ensured by the C^2A log exchange and the C^2 work object addition/deletion. By establishing a uniform representation of the C^2A log, the accumulation in and the reference to the collaborative memory can be implemented in an interoperable form. For this, the items below must be specified: *Relation between the essential elements of the collaborative workplace structure and authoring log structure*; *Storage request structure of the authoring log into the collaborative memory*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*; *The reference request structure of the authoring log from the collaborative memory*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*.

5. Collaborative Memory - Group Model Interface

The collaborative memory of the collaborative workplace stores various data developed during the group curriculum activities. This information is the ordered and managed information of the group model. Thereafter, the group model is registered. When some new group activity commences, the previous activity history and results from the group model are referred. Moreover, the collaborative memory stores data developed during public individual authoring activities. Therefore, the collaborative memory maintenance is necessary. For the correct reference of such information, the items below have to be defined: *Relation between the collaborative memory attribute(s) and the group model attribute(s); Relation between the collaborative memory attribute(s) and the (independent, individual) author model attribute(s); Output data structure from the collaborative memory into the group model and individual author model*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*.

Data Exchange in the Collaborative Authoring Environment

Virtual Agent in the Collaborative Authoring Environment

One of the essential structural elements of the collaborative authoring environment is the virtual agent (as in learning environments – see Paiva 1996).

The information exchange between the other essential structural elements can be done via agent(s). The attribute(s) of the appropriate essential elements are stored in the collaborative memory as well as the authoring

log developed during collaborative authoring. Furthermore, depending on the request from group member(s) and collaborative work object(s), agents refer the information in the collaborative memory and integrate the exchanged information into a defined form. The concrete function of agents is to cope with the behavioral differences of the essential structural elements. Moreover, the information exchange protocol content varies, according to the transmission source and reception destination, and according to the behavior or functions of the bi-directional structure of the essential elements. Therefore, agents are dynamic interfacing structural elements. However, the basis functions of the agents in the collaborative authoring environment are defined simply as the exchange, deletion, addition of essential structural elements.

Collaborative Authoring Agent

The technological issues to specify for the agents delimited by the above assumptions are represented by the 5 items below.

1. collaborative authoring environment agent(s) structure
2. collaborative authoring environment agent type(s)
3. essential elements of the collaborative authoring environment agent(s) structure
4. attribute(s) of the essential elements of the collaborative authoring environment agent(s) structure
5. relation(s) of the essential elements of the collaborative authoring environment agent(s) structure

Conclusion

The technological concept formation of the basic and common platform for building the cooperative and collaborative authoring environment (C^2AE) needs a collective effort and is an ongoing process. We have started in this paper from some considerations based on our experiences, and have gradually built specification items towards a future standardization. We have not followed the ramifications we have opened due to lack of space. To give just a flavor of next developments necessary, we mention here some further functions required by the C^2AE (Okamoto et al. 2001):

- *Coordination* (constrained and mediated by the external environment)
- *Reification* (material evidence in the external environment)
- *Illustration* (external representation)
- *Storage* (in later use, for the purpose of reflection)

Examples of general tools for supporting collaboration are as follows: *Concept Mapping tools; Editors for argumentation network; Work flow* (planning tool); *WYSIWIS* (What You See Is What I See). So far, we have integrated a few parallel projects with related goals (distance learning, life-long learning, re-usage of educational materials), under the name RAPSODY (Okamoto 2000) and RAPSODY-EXT (Okamoto & Cristea 2001).

In this paper, we have systematically elaborated, from an academic point of view, the fundamentals of the common functions and components for building a platform for a C^2AE for the future directions of standardization. However, these considerations and issues are only the first steps towards standardization, and our paper doesn't claim to be exhaustive on the matter. For further research, the presented standardization candidate items have to be refined further on, and their functionalities extended. Therefore, we need more investigations and discussions to persuade people about the importance of standardization for collaborative and cooperative authoring.

By using a common architectural, functional and technological basis and, moreover, by using other common concepts not treated in this paper, such as a common ontology for a static representation model, and a common dynamic model (e.g., in Petri net representation), real collaboration and cooperation within authoring environments for learning environment creation can be achieved.

References

Conklin, J. & Begeman, M.L. (1988): IBIS: A Hypertext Tool for Exploratory Policy Discussion, *ACM Transaction on Office Information Systems*, Vol.6, No.4, pp.303-331.

Cristea, A. I., Okamoto, T. (2001): Object-oriented Collaborative Course Authoring Environment supported by Concept Mapping in MyEnglishTeacher, *ETS journal*, 4(2) ISSN 1436-4522.

Dicheva, D. Aroyo, L. and Cristea, A.I.(2002): Collaborative Courseware Authoring Support, *WBE-CATE 2002*, Computers and Advanced Technology in Education, ISBN: 0-88986-332-6, 52-57.

Dillenbourg, P. and Self, J. (1994): Designing Human-Computer Collaborative Learning, *Computer Supported Collaborative Learning* (Ed.: O'Malley, C.), NATO ASI series vol. F-128, Berlin: Springer-Verlag, 245-264.

Dillenboug, P. (1999): *Collaborative Learning, cognitive and computational approaches*, Advances in learning and instruction series, Pergamon.

IEEE Computer Society Learning Technology Task Force (LTTF) http://lttf.ieee.org/

ISO/IEC JTC1Standards for Information Technology for Learning, Education, and Training (SC36) http://jtc1sc36.org/

ISO/IEC Joint Technical Committee 1(ISC/IEC JTC1): http://www.jtc1.org/

Malcolm, K. and Crowe (1994): *Cooperative Work with Multimedia*, Springer, ISBN3-540-58315-7.

O'Malley, C. (1994) (Ed.): *Computer Supported Collaborative Learning*, NATO ASI series Vol.F-128, Berlin: Springer.

Okamoto, T. (2000): The Distance Ecological Model to support, Self/Collaborative-Learning in the Internet Environment, *ISSEI 2000*, Bergen, Norway, Section V; Workshop no.: 511.

Okamoto, T. Cristea, A. and Kayama, M. (2000): ICCE 2000 Invited Talk, Towards Intelligent Media-Oriented Distance Learning and Education Environments, *ICCE 2000 proceedings.*

Okamoto, T. Cristea, A. (2001): A Distance Ecological Model for Individual and Collaborative-learning support, *Educational Technology and Society*, vol. 4, Issue 2 (April 2001), Special Issue on Developing Creativity and Large Mental Outlook in the Computer Age, http://ifets.ieee.org/periodical/vol_2_2001/v_2_2001.html

Okamoto, T., Kayama, M. and Cristea, A. (2001): Consideration of building a Common Platform of Collaborative Learning Environment, *ICCE International Conference on Computer in Education, Enhancement of Quality Learning through Information and Communication Technology*, Asian-Pacific Chapter of AACE, Seoul, Korea.

Paiva, A. (1996): Communicating with Learner Modeling Agents, *ITS 96, Workshop on Architectures and Methods for Designing Cost-Effective and Reusable ITSs*, Montreal.

Synnes, K., Parnes, P., Widen, J. and Schefstroem, D. (1999): Net-based Learning for the Next Millennium, *SCI/ISAS99*, Florida, USA.

The International Organization for Standardization (ISO): http://www.iso.ch/

Winograd, T. & Flores, F. (1986): *Understanding Computers and Cognition*, Addison-Wesley.

Acknowledgment

This study was inspired by the next generation-WG of collaborative authoring technologies in ALIC (Advanced Authoring Infrastructure Consortium: http://www.alic.gr.jp/), Japan.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

[X] This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

[ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").